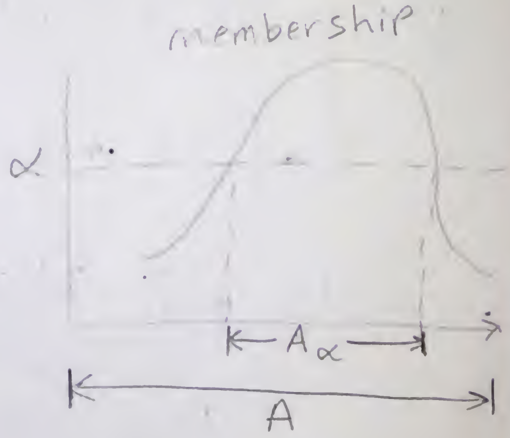
Fuzzy

A Fuzzy set $A \subseteq R^n$ (A_α α-cut set) is Convex if and only if:

$$\mu_A(\lambda x_1 + (1-\lambda)x_2) \geq \min\left[\mu_A(x_1), \mu_A(x_2)\right]$$

for all $x_1, x_2 \in \mathbb{R}^n$



الحل

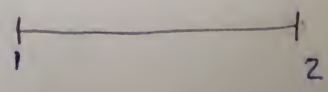
Convex $\Longleftrightarrow$ الشرط يتحقق

$\Rightarrow$ Let A_α is Convex for all.

$\Rightarrow \lambda x_1 + (1-\lambda)x_2 \in A_\alpha \quad 0 \leq \lambda \leq 1$

$\Rightarrow \mu_A(x_1) \geq \alpha \; ; \; \mu_A(x_2) \geq \alpha$

$1(\lambda) + 2(1-\lambda)$



$\therefore \mu_A(\lambda x_1 + (1-\lambda)x_2) \geq \alpha$

$0 \leq \lambda \leq 1$

$$\Rightarrow \mu_A(\lambda x_1 + (1-\lambda) x_2) \geq \alpha = \min\left(\mu_A(x_1), \mu_A(x_2)\right)$$

<u>if</u> $\mu_A(x_1) \leq \mu_A(x_2)$

الإتجاه العكسي

<u>Let</u> $\mu_A[\lambda x_1 + (1-\lambda)x_2] \geq \min[\mu_A(x_1), \mu_A(x_2)]$

$$A_\alpha \neq \phi$$

<u>if</u> $\alpha = \mu_A(x_1) \leq \mu_A(x_2)$

$$\Rightarrow \mu_A[\lambda x_1 + (1-\lambda) x_2] \geq \min[\alpha, \mu_A(x_2)]$$

$$\Rightarrow \lambda x_1 + (1-\lambda) x_2 \in A_\alpha$$

$\therefore A_\alpha$ is Convex

<u>Magnitude of fuzzy set</u>

<u>[1] Scaler Cardinality :-</u>

← يمثل هذا المقياس مجموع درجات الإنتماء لجميع عناصر الفترة.

$$|A| = \sum_{x \in A} \mu_A(x)$$

$\boxed{2}$ Relative Cardinality:-

$$||A|| = \frac{|A|}{|X|} = \frac{\sum\limits_{x \in A} \mu_A(x)}{\text{no. of element of } x}$$

← هذا المقياس يمثل مقدار التأكد من مصداقية الـ (data)
بالنسبة للعينة التي تجعل الفئة فئة فازية .

EX: Consider the fuzzy set: short, medium, tall

cm	short	middle	tall
14	1	0	0
15	1	0	0
16	0.9	0.1	0
17	0.7	1	0
18	0.3	0.8	0.3
19	0	0	1

$\boxed{1}$ Compare the support of each set

$\boxed{2}$ Compare the α-cut of each set at $\alpha = 0.5$

$\boxed{3}$ $|short|$ and $||short||$

Solution

$\boxed{1}$

$\text{supp}(A) = \{x : \mu(x) > 0\}$

$\text{supp}(\text{short}) = \{14, 15, 16, 17, 18)$

$\text{supp}(\text{medium}) = \{16, 17, 18\}$

$\text{supp}(\text{tall}) = \{18, 19\}$

$\boxed{2}$ $A_\alpha = \{x : \mu(x) > \alpha\}$

$(\text{short})_{0.5} = \{14, 15, 16, 17\}$

$(\text{medium})_{0.5} = \{17, 18\}$

$(\text{tall})_{0.5} = \{19\}$

$\boxed{3}$

$|\text{short}| = 1 + 1 + 0.9 + 0.7 + 0.3 = 3.9$

$||\text{short}|| = \frac{3.9}{6}$

$\boxed{4}$ Lec 7

→ operation on Fuzzy set:-

① Complement:

$$\mu_A(x) = -\mu_A(x) \; : \; x \in X$$

② union :-

$$\mu_{A\cup B}(x) = \max\{\mu_A(x), \mu_B(x)\}$$

③ intersection :-

$$\mu_{A\cap B}(x) = \min\{\mu_A(x), \mu_B(x)\}$$

$\boxed{EX}$ Let $\tilde{A} = \frac{0.3}{1} + \frac{0}{2} + \frac{0.4}{3} + \frac{0.8}{4} + \frac{1}{5}$,

$\tilde{B} = \frac{0.2}{1} + \frac{0.3}{2} + \frac{0.1}{3} + \frac{0.2}{4} + \frac{0.4}{5}$ find

① $\overline{\tilde{A}}$ ② $\tilde{A} \cup \tilde{B}$

③ $\tilde{A} \cap \tilde{B}$ ④ $\tilde{A} - \tilde{B}$

⑤ $\tilde{A} \,\Delta\, \tilde{B}$

Solution

1. $\bar{\tilde{A}} = \frac{0.7}{1} + \frac{1}{2} + \frac{0.6}{3} + \frac{0.2}{4} + \frac{0}{5}$

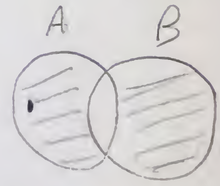
2. $\tilde{A} \cup \tilde{B} = \frac{0.3}{1} + \frac{0.3}{2} + \frac{0.4}{3} + \frac{0.8}{4} + \frac{1}{5}$

3. $\tilde{A} \cap \tilde{B} = \frac{0.2}{1} + \frac{0}{2} + \frac{0.1}{3} + \frac{0.2}{4} + \frac{0.4}{5}$

4. $\tilde{A} - \tilde{B} = \tilde{A} \cap \tilde{B} = \frac{0.2}{1} + \frac{0}{2} + \frac{0.1}{3} + \frac{0.2}{4} + \frac{0.4}{5}$

5. $\tilde{A} \Delta \tilde{B} = (\tilde{A} \cap \bar{\tilde{B}}) \cup (\tilde{B} \cap \bar{\tilde{A}})$.

$\cancel{\tilde{A} \cap \tilde{B} = \frac{0.2}{1} + \frac{0}{2} + \frac{0.1}{3} + \frac{0.2}{4} + \frac{0.4}{5}}$



$A \Delta B = (A - B) \cup (B - A)$

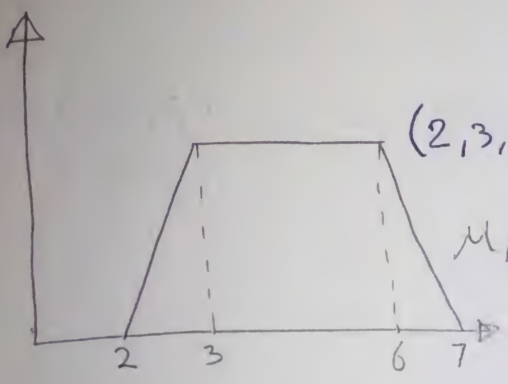
$\tilde{B} \cap \bar{\tilde{A}} =$

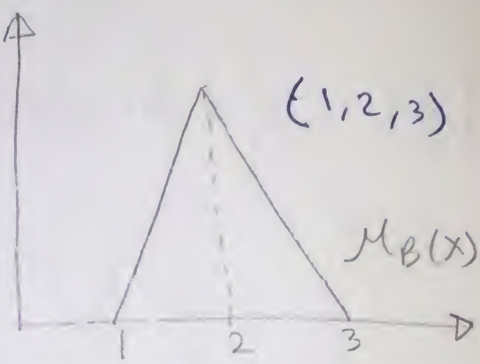
تكملة

← في الحالة المتصله عند اعطاء $\mu(x)$ هنقدر نفرق

الفئة في الحالة (discrete)

$\boxed{EX}$ Graphically represent the fuzzy set operation if the member ship.





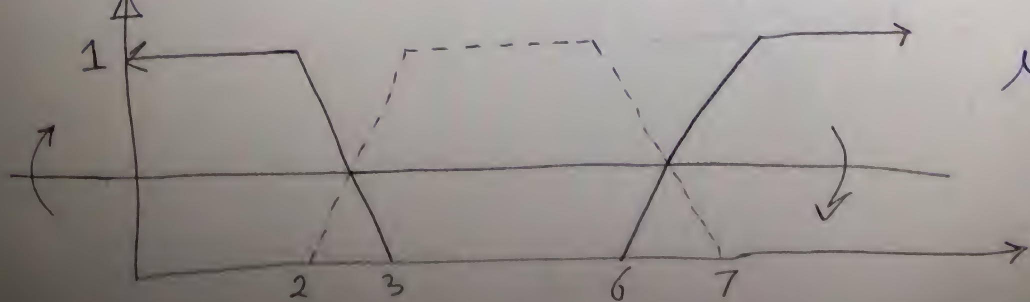
Find

$\boxed{1}$ $\mu_{\bar{A}}(x)$ $\boxed{2}$ $\mu_{\bar{B}}(x)$ ③ $\mu_{A\cup B}(x)$

$\boxed{4}$ $\mu_{A\cap B}(x)$

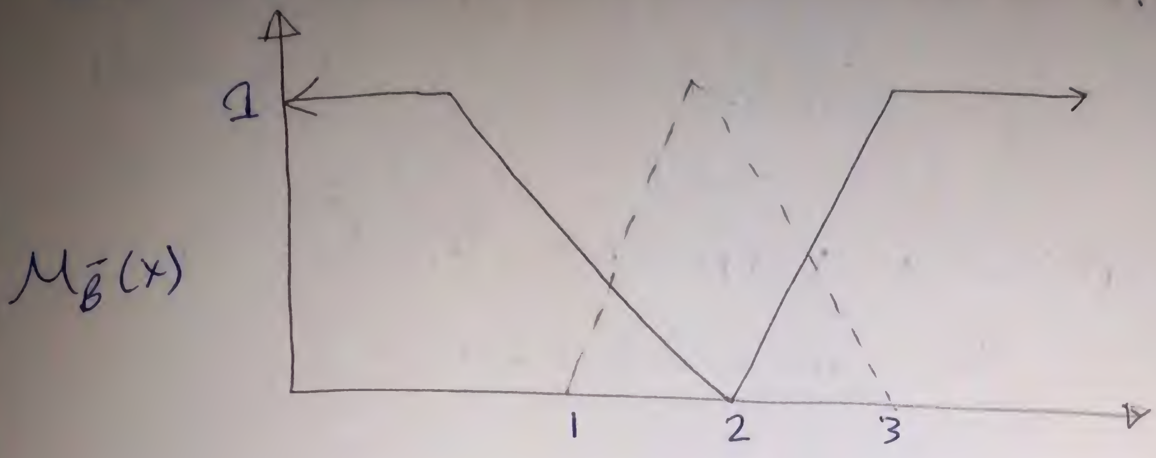
Sol

$\boxed{1}$

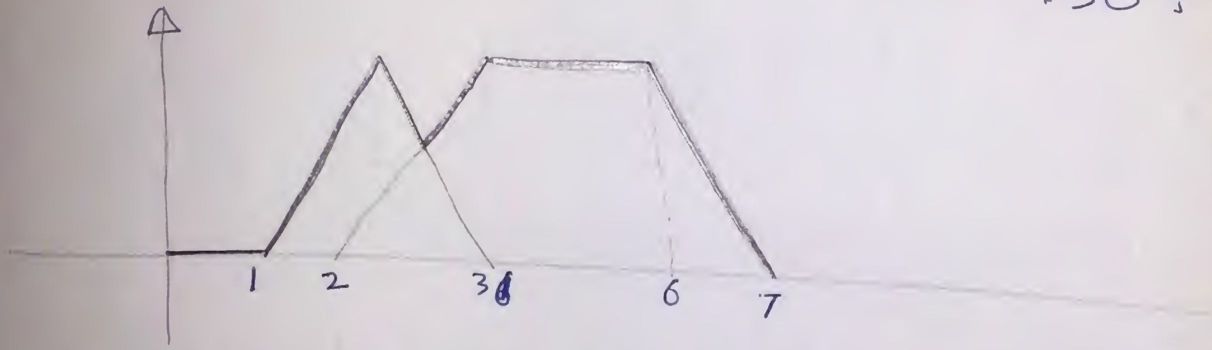


$\mu_{\bar{A}}(x)$

$\boxed{2}$



$\boxed{3}$ ← هنرسم الرسمتين فوق بعض ونمشي على الحرف اللي فوق في الإتحاد.



$\boxed{4}$ في التقاطع هنرسم الرسمتين على بعض ونمشي على الحرف اللي تحت.